

IN THE CLAIMS:

Please add Claims 25-28 as follows.

1. (Previously Presented) A stereoscopic image display method for permitting an observer to stereoscopically observe image information displayed on an image display element, comprising the steps of:

dividing each of parallax images, corresponding to a plurality of different view points, into predetermined stripe images;

synthesizing a synthetic parallax image from the stripe images;

guiding display light, from stripe images corresponding to one view point in the synthetic parallax image on the image display element displaying the synthetic parallax image, to a mask member having a mask pattern with predetermined openings and shields, using a second optical system placed in front of the image display element; and

converging display light passing through the openings of the mask member to a position corresponding to the view point on an observation surface a predetermined distance apart, using a first optical system,

wherein the second optical system has a predetermined periodic structure in the horizontal direction formed by a first plurality of elementary optical elements respectively corresponding to one period of the periodic structure in the horizontal direction, and has a predetermined periodic structure in the vertical direction formed by a second plurality of elementary optical elements respectively corresponding to one period of the periodic structure in the vertical direction, wherein the periodic structures in the

horizontal and vertical directions are disposed in that order from the light incident side, and wherein an elementary optical element in the first plurality of elementary optical elements has optical action in the horizontal direction and optical action in the vertical direction different from the optical action in the horizontal direction and the optical action in the vertical direction of an elementary optical element in the second plurality of elementary optical elements.

2. (Original) The stereoscopic image display method according to Claim 1, wherein among image display light from pixels forming each stripe image, display light reaching a position of an observer's view point corresponding to the stripe image is condensed to the mask member by the second optical system so as to pass through the openings of the mask member and the other light is intercepted by the shields.

3. (Previously Presented) The stereoscopic image display method according to Claim 1, wherein said second optical system forms images of pixels of said image display element on said mask member in the vertical direction and a position of a focal point of said second optical system is approximately coincident with a position of the mask member in the horizontal direction.

4. (Original) The stereoscopic image display method according to Claim 1, wherein N view points (N is an integer not less than 2) are arranged at equal intervals on the observation surface the predetermined distance apart.

5. (Previously Presented) The stereoscopic image display method according to Claim 4, wherein said first optical system and second optical system have predetermined periodic structure in the horizontal direction, and at least one of the second optical system and the image display element is placed on planes defined by intersections of straight lines connecting i) two adjacent view points out of the N view points arranged at the equal intervals in the horizontal direction and ii) a horizontal center of each elementary optical element forming the second optical system.

6. (Cancelled)

7. (Previously Presented) The stereoscopic image display method according to Claim 4, wherein intersecting points of straight lines connecting i) two adjacent view points out of the N view points arranged at the equal intervals and ii) a horizontal center of each elementary optical element forming said second optical system are common to at least one of a) horizontal centers of the respective elementary optical elements forming the second optical system and (agree with) b) horizontal centers of pixels forming the image display element.

8. (Previously Presented) The stereoscopic image display method according to Claim 1, wherein the following relations are met:

$$Nd * HL1/E = Lhd/(Lhd + Lh0) \quad (h1)$$

$$Hd/HL1 = (Lh0 + Lhd)/Lh0 \quad (h2)$$

$$NL2*HL1/E = LhL2/(LhL2 + Lh0) \quad (h3)$$

$$HL2/HL1 = (Lh0 + LhL2)/Lh0 \quad (h4)$$

$$Hl/E = Lh1/(Lh1 + Lh0) \quad (h5)$$

$$Hl/HL1 = (Lh0 + Lh1)/Lh0 \quad (h6)$$

$$H1*Lh1a/Lh1 = HL1*Lh1b/Lh1 \quad (h7)$$

$$Lh1a + Lh1b = Lh1 \quad (h8)$$

$$Hm/H1 = Lh1a/Lh1 \quad (h9)$$

where N view points (N is an integer not less than 2) are arranged at equal intervals E on the observation surface the predetermined distance apart, HL1 is a horizontal period of elementary optical elements forming said first optical system, Hm a horizontal width of the openings of said mask member, HL2 a horizontal period of the first plurality of elementary optical elements of said second optical system, Hd a horizontal pixel pitch of the image display element, LhL2 and Lhd an optical reduced distance between the first optical system and the second optical system and an optical reduced distance between the first optical system and the image display element, respectively, Lh0 an optical reduced distance from the observation surface to the first optical system, Lh1 an optical reduced distance from the first intersecting plane, when measured from the first optical system toward the image display element, out of the intersecting planes of line groups connecting two adjacent view points out of the N view points and each pixel of the image display element, to the first optical system, Lh1a and Lh1b an optical reduced distance from the first optical system to the mask member and an optical reduced distance from the mask

member to the first intersecting plane from the first optical system out of the intersecting planes, and Nd and NL2 integers not less than 2 ( $Nd > NL2$ ).

9. (Original) The stereoscopic image display method according to Claim 1, wherein relations of Eq. (V1N) to Eq. (V3N) or relations of Eq. (V1N) to Eq. (V4N) below are met:

$$Vd:Vm = LV1:LV2 \quad (V1N)$$

$$2 \cdot N \cdot Vd:VL = LV1+LV2 : LV2 \quad (V2N)$$

$$1/LV1 + 1/LV2 = 1/fV \quad (V3N)$$

$$N \cdot Vd:VL = LV0+LV1+LV2 : LV0+LV2 \quad (V4N)$$

where  $Vd$  is a vertical pixel pitch of said image display element,  $Vm$  a vertical width of the openings or the shields of the mask pattern of said mask member,  $LV1$  an optical reduced distance from the image display element to a surface of the second optical system having optical action in the vertical direction,  $LV2$  an optical reduced distance from the surface of the second optical system having the optical action in the vertical direction to the mask pattern,  $fV$  a vertical focal length of individual elementary optical elements forming the second optical system,  $LV0$  an optical reduced distance between the mask pattern and the observation surface, and  $N$  the number of view points ( $N$  is an integer not less than 3).

10. (Original) The stereoscopic image display method according to Claim 1, wherein relations of Eq. (V1) to Eq. (V3) or relations of Eq. (V1) to Eq. (V4) below are met:

$$Vd:Vm = LV1:LV2 \quad (V1)$$

$$2 \cdot Vd:VL = LV1+LV2 : LV2 \quad (V2)$$

$$1/LV1 + 1/LV2 = 1/fV \quad (V3)$$

$$Vd:VL = LV0+LV1+LV2 : LV0+LV2 \quad (V4)$$

where said number of viewpoints is 2,  $Vd$  is a vertical pixel pitch of said image display element,  $Vm$  a vertical width of the openings or the shields of the mask pattern of said mask member,  $LV1$  an optical reduced distance from said image display element to a surface of said second optical system having optical action in the vertical direction,  $LV2$  an optical reduced distance from the surface of the second optical system having the optical action in the vertical direction to the mask pattern,  $fV$  a vertical focal length of individual elementary optical elements forming the second optical system, and  $LV0$  an optical reduced distance between the mask pattern and the observation surface.

11. (Previously Presented) A stereoscopic image display method for permitting an observer to stereoscopically observe image information displayed on an image display element, comprising the steps of:

dividing each of parallax images, corresponding to a plurality of different view points, into predetermined stripe images;

synthesizing a synthetic parallax image from the stripe images;

guiding display light, from stripe images corresponding to one view point in the synthetic parallax image on the image display element displaying the synthetic parallax image, to a mask member having a mask pattern with predetermined openings and shields, using a second optical system placed in front of the image display element; and

converging display light passing through the openings of the mask member to a position corresponding to the view point on an observation surface a predetermined distance apart, using a first optical system,

wherein the second optical system comprises an array of elementary optical elements having a predetermined periodic structure in the horizontal direction and a predetermined periodic structure in the vertical direction, wherein the optical action of an elementary optical element in the horizontal direction differs from the optical action in the vertical direction.

12. (Original) The stereoscopic image display method according to Claim 1, wherein said first and second optical systems comprise lenticular lenses.

13. (Previously Presented) The stereoscopic image display method according to Claim 1, wherein said second optical system is comprised of a lenticular lens in which cylindrical lenses being elongated in the vertical direction and having an optical power only in the horizontal direction are arranged at predetermined intervals in the horizontal direction and a lenticular lens in which cylindrical lenses being elongated in the horizontal

direction and having an optical power only in the vertical direction are arranged at predetermined intervals in the vertical direction.

14. (Previously Presented) The stereoscopic image display method according to Claim 11, wherein said second optical system is a microlens array in which toroidal lenses having a focal length in the vertical direction and a focal length in the horizontal direction different from each other are arranged in a predetermined period in the horizontal direction and in a predetermined period in the vertical direction.

15. (Previously Presented) A stereoscopic image display method using an image display element and a mask member having a mask pattern with predetermined openings and shields, said method comprising the steps of:

directing image display light from the image display element; and  
effecting the directing of the image display light with a first optical system and a second optical system respectively disposed on opposite sides of the mask pattern in the path of the directed image display light, wherein the second optical system has a predetermined periodic structure in the horizontal direction formed by a first plurality of elementary optical elements and a predetermined periodic structure in the vertical direction formed by a second plurality of elementary optical elements, in order from the light incident side, and an elementary optical element in the first plurality of elementary optical elements has optical action in the horizontal direction and optical action in the vertical

direction different from optical action in the horizontal and vertical direction of an elementary optical element in the second plurality of elementary optical elements.

16. (Previously Presented) A stereoscopic image apparatus using the stereoscopic image display method as set forth in any one of Claims 1 to 5 and 7 to 15.

17. (Previously Presented) A stereoscopic image display apparatus for providing parallax images corresponding to a plurality of different view points on an observation surface to permit an observer to stereoscopically observe image information displayed on an image display element, comprising:

a display device for displaying a synthetic parallax image obtained by synthesizing the parallax images corresponding to a plurality of different view points;

a mask member having predetermined openings and shields placed in front of the display device;

a first optical member, placed in front of the mask member, for providing the parallax images corresponding to a plurality of different view points on the observation surface displaced with a predetermined distance; and

a second optical member, placed in between the display device and the mask member, for guiding a light from the display device at a predetermined position of the mask member,

wherein the display device generates a divergent light to display an image,

wherein the second optical member includes a vertical lenticular lens having a periodic structure in a horizontal direction, the vertical lenticular lens comprising a plurality of elementary optical elements that each constitute one period of the periodic structure in the horizontal direction, the vertical lenticular lens being spaced apart from the mask member by substantially the same distance as a focal distance of one of the elementary optical elements of the vertical lenticular lens,

wherein the mask member includes an opening positioned at a focal point of each of the elementary optical elements of the vertical lenticular lens,

and wherein the first optical member is a lenticular lens having a periodic structure in a horizontal direction and comprises a plurality of elementary optical elements that each constitute one period of the periodic structure in the horizontal direction, the lenticular lens of the first optical member being spaced from the mask member by substantially the same distance as a focal distance of one of the elementary optical elements of the first optical member.

18. (Previously Presented) A stereoscopic image display apparatus according to Claim 17, wherein the vertical lenticular lens of the second optical member has optical power in the horizontal direction and the synthetic parallax image is guided to a position corresponding to the mask member.

19. (Previously Presented) A stereoscopic image display apparatus according to Claim 18, wherein the second optical member further comprises a horizontal lenticular lens having optical power in the vertical direction which images the image displayed on the display device onto the mask member in the vertical direction.

20. (Previously Presented) A stereoscopic image display apparatus according to one of Claims 17 to 19, wherein the synthetic parallax image is formed by dividing each of parallax images corresponding to a plurality of different view points into predetermined stripe images and synthesizing the stripe images.

21. (Previously Presented) A stereoscopic image display apparatus according to one of Claims 17 to 19, wherein the focal distance of an elementary optical element of the vertical lenticular lens of the second optical member is different from the distance between the vertical lenticular lens of the second optical member and the display device.

22. (Previously Presented) A stereoscopic image display apparatus according to one of Claims 17 or 18, wherein the second optical member comprises individual vertical and horizontal lenticular lenses.

23. (Previously Presented) The stereoscopic display method according to Claim 11, wherein said first and second optical systems comprises microlens arrays.

24 (Previously Presented) A stereoscopic image display method using an image display element and a mask member having a mask pattern with predetermined openings and shields, said method comprising the steps of:

directing image display light from the image display element; and  
effecting the directing of the image display light with a first optical system and a second optical system respectively disposed on opposite sides of the mask pattern in the path of the directed image display light, wherein the second optical system has an array of elementary optical elements having a predetermined periodic structure in the horizontal direction and a predetermined periodic structure in the vertical direction, and an optical action of an elementary optical element in the horizontal direction differs from the optical action in the vertical direction.

25. (New) A stereoscopic image display apparatus for providing a parallax image for a left eye to a left eye of a user and a parallax image for a right eye to a right eye of the user, the parallax image for a left eye being different from the parallax image for a right eye, comprising:

an image display element for respectively dividing the parallax image for a left eye and the parallax image for a right eye into a plurality of stripe images whose lengths in a horizontal direction are longer than lengths in the other direction and displaying a plurality of pixels of synthesized parallax images by respectively arranging stripe images of the parallax image for a left eye and stripe images of the parallax image for a right eye in a vertical direction side by side and synthesizing the arranged stripe images; and

a second optical system, a mask member including an opening part and a shield part, and a first optical system arranged in a order from a side of said image display element,

wherein said second optical system includes a second lens array having a plurality of second lenses having a refractivity toward a horizontal direction, each of said plurality of second lenses being provided in a second periodic interval distance consisting of a predetermined distance in a horizontal direction, and

wherein said first optical system includes a first lens array having a plurality of first lenses having a refractivity toward a horizontal direction, each of said plurality of first lenses being provided in a first periodic interval distance consisting of a predetermined distance in a horizontal direction.

26. (New) A stereoscopic image display apparatus according to claim 25, wherein said second optical system further includes a third lens array having a plurality of third lenses having reflectivity towards a vertical direction, each of said plurality of third lenses being provided in a third periodic interval distance consisting of a predetermined distance in a horizontal direction, and said third lens array forms an image of the plurality of pixels at a position of the mask member in a vertical cross section surface.

27. (New) A stereoscopic image display apparatus according to claim 25, wherein said second lens array is a plurality of toroidal lenses having a refractivity toward a vertical direction and being provided in a third periodic interval in a vertical direction, and

said second lens array forms an image of the plurality of pixels at a position of the mask member in a vertical cross section surface.

28. (New) A stereoscopic image display apparatus for providing a parallax image for a left eye to a left eye of a user and a parallax image for a right eye to a right eye of the user, the parallax image for a left eye being different from the parallax image for a right eye, comprising:

an image display element for respectively dividing the parallax image for a left eye and the parallax image for a right eye into a plurality of stripe images and displaying a plurality of pixels of synthesized parallax images by respectively arranging stripe images of the parallax image for a left eye and stripe images of the parallax image for a right eye in a vertical direction side by side and synthesizing the arranged stripe images; and

a second optical system, a mask member including an opening part and a shield part, and a first optical system arranged in a order from a side of said image display element,

wherein said second optical system includes a second lens array having a plurality of second lenses having a refractivity toward a horizontal direction, each of said plurality of second lenses being provided in a second periodic interval distance consisting of a predetermined distance in a horizontal direction, and

wherein said first optical system includes a first lens array having a plurality of first lenses having a refractivity toward a horizontal direction, each of said plurality of first lenses being provided in a first periodic interval distance consisting of a predetermined distance in a horizontal direction, and

wherein said stereoscopic image display apparatus is constituted in a manner that a top of said first lens, a center of an opening portion or a shield part and a top of the second lens are positioned on a line connecting positions of the left eye, the right eye and the plurality of pixels.